

species as *Disporum trachycarpum* S. Wats. and *Trientalis americana* (Pers.) Pursh also have their northern limit in this district.

Hutchinson's studies in the forests of Ontario indicate that the advance of mesophytic conditions, embodied in the development of a deciduous forest, has lagged behind temperature changes in post-Glacial time, and awaits the slower development of soils.¹ The forests of the Athabasca-Great Slave Lake region may present the same situation in an earlier stage of successional development.

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THE FLORA OF THE ELIZABETH ISLANDS, MASSACHUSETTS

JOHN M. FOGG, JR.

(Continued from page 180)

Native plants. The 558 species of indigenous plants on the Elizabeth Islands fall rather clearly into three fairly well differentiated categories. In the first place, there is the southern element—plants of the southern coastal plain which range north from Florida or the Gulf States to achieve their northern limit in southeastern Massachusetts, some of them passing on to Nova Scotia or Newfoundland; then there is a group of species of northern affinities, many of which have already been mentioned in speaking of Nantucket and Cape Cod, which range south or southwest to Massachusetts or, at most, New Jersey. And, finally, there is a large and very important block of plants which fall into neither of the two preceding classes, but belong rather to a continental upland flora than to that which characterizes the lowlying reaches of most of Cape Cod and the adjacent islands. It will be well to analyze briefly the constituents of these three groupings before proceeding further.

The Southern Element. In rather striking contrast to the situation found on Nantucket, where, it will be remembered, over 50% of the indigenous flora is prevailingly more southern in its hue, as well as on the middle part of Cape Cod, where, as has been seen, the native flora is preëminently that of the southern coastal plain, is the

¹ Hutchinson, A. H. *Limiting Factors in Relation to Specific Ranges of Tolerance of Forest Trees.* Bot. Gaz. lxvi. 465-493 (1918).

fact that on the Elizabeth Islands this southern element finds expression in something less than 20% of the total indigenous flora.

It is true that there are a few species of plants of the southern coastal plain which, on the Elizabeth Islands are near the very northeastern limit of their distribution. *Paspalum setaceum*, for example, is known in Massachusetts only from the Elizabeths and Nantucket.¹ *Panicum longifolium* is found nowhere east of Pasque Island, at which place it is abundant in the peaty bog hollows,² although it is represented in Nova Scotia by var. *tusketense*.³ *Tipularia discolor* is near the northeastern limit of its range on one of the Elizabeth Islands (Nashawena) and on Martha's Vineyard. *Rumex verticillatus*, long known from Block Island, but otherwise rare in New England, has recently been collected on the Elizabeths. *Hydrocotyle Canbyi* and *H. verticillata*, both known on the basis of old records from Woods Hole (for years their only known station in New England) have, during the course of the present survey, been discovered on the Elizabeth Islands as well. *Solidago minor* ranges from Alabama and Florida to Virginia, then "jumps" to Nantucket, where it was reported by Bicknell, and is now known to occur on Naushon, the largest of the Elizabeths. Thus it will be seen, that these islands, as is true of nearly every other locality along the coast from New Jersey northward, are not totally lacking in records which represent interesting, or even spectacular, northern extensions of plants which are essentially southern in their affinities.

In general, however, the flora of the Elizabeth Islands far from suggests that of the coastal plain. The following enumeration, which includes the seven species just mentioned, constitutes a nearly complete list of the plants known from these islands which are also characteristic species of the coastal strip, ranging from the Gulf States, Florida or Georgia northeastward. Many of them, of course, continue farther north and east, being known from Nova Scotia, New Brunswick or even Newfoundland, but they are, for the most part, plants of a pronounced austro-riparian origin. It would be difficult to make such a list comprehensive, for, in the absence of adequate data concerning the complete ranges of every species, it is not always easy to state categorically whether a plant belongs exclusively to the southern coastal plain, or whether it enjoys an Alleghanian-Carolin-

¹ See Weatherby, RHODORA, xxx. 133 (1928).

² See Fogg, RHODORA, xxxi. 39 (1929).

³ See Fernald, RHODORA, xxiii. 192 (1921).

ian distribution. All of the species listed below, with the exception of those marked with an asterisk, are known also from Cape Cod.

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|------------------------------------|-----------------------------|
| Woodwardia virginica | Boehmeria cylindrica, var. |
| Thelypteris simulata | Drummondiana |
| Lycopodium inundatum, var. | *Rumex verticillatus |
| Bigelovii | Polygonum glaucum |
| Chamaecyparis thyoides | P. punctatum |
| Sparganium eurycarpum | Drosera intermedia |
| Potamogeton Oakesianus | Pyrus arbutifolia |
| P. pulcher | Rubus Andrewsianus |
| Andropogon scoparius, var. | Rosa palustris |
| polyclados | Prunus maritima |
| A. virginicus | Desmodium obtusum |
| *Paspalum setaceum | D. marilandicum |
| P. pubescens | Lespedeza capitata |
| Panicum meridionale | Polygala cruciata |
| P. albemarlense | Euphorbia polygonifolia |
| P. oricola | Ilex opaca |
| *P. longifolium | I. glabra |
| P. Commonsianum | Hibiscus Moscheutos |
| Setaria geniculata | Hypericum virginicum |
| Cenchrus pauciflorus | Helianthemum canadense |
| Stipa avenacea | H. Bicknellii |
| Aristida purpurascens | Lechea villosa |
| Ammophila breviligulata | L. maritima |
| Spartina alterniflora, var. pilosa | Decodon verticillatus |
| *Diplachne maritima | Rhexia virginica |
| Cyperus erythrorhizos | Myriophyllum scabratum |
| C. ferax | Proserpinaca palustris |
| Eleocharis rostellata | *Sanicula canadensis |
| Fimbristylis autumnalis | Hydrocotyle umbellata |
| Scirpus Olneyi | H. Canbyi |
| S. robustus | H. verticillata |
| Rynchospora capitellata | Ptilimnium capillaceum |
| Carex Longii | Clethra alnifolia |
| C. straminea | Rhododendron viscosum, var. |
| C. alata | glaucum |
| C. Howei | Leucothoe racemosa |
| C. Mitchelliana | Samolus floribundus |
| Xyris caroliniana | Bartonia virginica |
| Juncus effusus, var. costulatus | B. paniculata |
| Luzula campestris, var. echinata | Nymphoides lacunosum |
| Smilax rotundifolia | Asclepias verticillata |
| Iris prismatica | Teucrium canadense, var. |
| Sisyrinchium graminoides | littorale |
| Pogonia ophioglossoides | Ilysanthes inaequalis |
| Calopogon pulchellus | Gratiola aurea |
| *Tipularia discolor | Agalinis maritima |
| Myrica caroliniensis | Utricularia gibba |
| Spergularia rubra | *Plantago virginica |

Eupatorium hyssopifolium
 Solidago Elliottii
 *S. minor
 S. tenuifolia
 Aster dumosus
 A. vimineus

Pluchea camphorata
 Gnaphalium purpureum
 Coreopsis rosea
 Krigia virginica
 Lactuca hirsuta
 Hieracium Gronovii

A point requiring particular emphasis is, that many of these species are by no means common on the islands. Indeed, a few of them, such as *Thelypteris simulata*, *Paspalum setaceum*, *Panicum longifolium*, *P. Commonsianum*, *Cenchrus pauciflorus*, *Diplachne maritima*, *Eleocharis rostellata*, *Carex straminea*, *C. alata*, *C. Mitchelliana*, *Luzula campestris*, var. *echinata*, *Tipularia discolor*, *Rumex verticillatus*, *Prunus maritima*, *Ilex glabra*, *Sanicula canadensis*, *Hydrocotyle Canbyi*, *Rhododendron viscosum*, var. *glaucum*, *Triosteum perfoliatum*, *Solidago minor* and *Coreopsis rosea*, are known only from a single locality, while certain others, though less restricted, are nevertheless rare and local. And seldom, if ever, are these coastal plain plants present in sufficient abundance to create the impression, inescapable on Cape Cod, of a southern flora transplanted almost *en masse*.

Pursuing this last idea further, it will be found interesting to contrast with the list just given a list of some of the southern coastal plain plants which are known to occur on Cape Cod (most of them from the Middle Cape), but which have not yet been found on the Elizabeth Islands:

Pteridium aquilinum, var.
pseudocaudatum
Sagittaria Engelmanniana
S. graminea
S. teres
Paspalum psammophilum
Panicum verrucosum
P. Bicknellii
P. microcarpon
P. annulum
P. mattamuskeetense
P. spretum
P. Wrightianum
P. auburne
P. tsugetorum
P. columbianum
P. polyanthes
P. Ashei
P. scoparium

Aristida dichotoma
A. gracilis
Spartina cynosuroides
Tridens flavus
Cyperus filicinus, var.
microdontus
C. Grayii
Eleocharis Robbinsii
E. melanocarpa
Psilocarya scirpoides
Scirpus atrovirens, var.
georgianus
S. Eriophorum
Fuirena squarrosa
Hemicarpha micrantha
Rynchospora macrostachya
R. inundata
R. Torreyana
R. capitellata, var. *discutiens*

<i>Scleria reticularis</i>	<i>Acer rubrum</i> , var. <i>tridens</i>
<i>Carex annectens</i>	<i>Ceanothus americanus</i> , var.
<i>C. intumescens</i>	<i>intermedius</i>
<i>C. bullata</i> , var. <i>Greenei</i>	<i>Vitis cordifolia</i>
<i>Arisaema Stewardsonii</i>	<i>Hypericum adpressum</i>
<i>Peltandra virginica</i>	<i>Hudsonia ericoides</i>
<i>Orontium aquaticum</i>	<i>Viola emarginata</i>
<i>Xyris Smalliana</i>	<i>V. primulifolia</i>
<i>Juncus subcaudatus</i>	<i>Opuntia vulgaris</i>
<i>J. aristulatus</i>	<i>Rhexia mariana</i>
<i>Lilium superbum</i>	<i>Oenothera linearis</i>
<i>Aletris farinosa</i>	<i>O. longipedicellata</i>
<i>Lachnanthes tinctoria</i>	<i>Proserpinaca pectinata</i>
<i>Myrica asplenifolia</i>	<i>P. intermedia</i>
<i>Quercus stellata</i>	<i>Lilaeopsis chinensis</i>
<i>Q. prinoides</i>	<i>Sabatia campanulata</i>
<i>Q. ilicifolia</i>	<i>Cuscuta compacta</i>
<i>Comandra umbellata</i>	<i>Onosmodium virginianum</i>
<i>Polygonum setaceum</i>	<i>Stachys hyssopifolia</i>
<i>Polygonella articulata</i>	<i>Lycopus sessilifolius</i>
<i>Acnida cannabina</i>	<i>Agalinis purpurea</i>
<i>Drosera filiformis</i>	<i>Aureolaria pedicularia</i> , var.
<i>Cassia Chamaecrista</i>	<i>caesariensis</i>
<i>Crotalaria sagittalis</i>	<i>Utricularia inflata</i>
<i>Lupinus perennis</i>	<i>U. subulata</i>
<i>Tephrosia virginiana</i>	<i>Viburnum pubescens</i>
<i>Desmodium rotundifolium</i>	<i>Eupatorium verbenaefolium</i>
<i>D. marilandicum</i>	<i>Mikania scandens</i>
<i>Lespedeza procumbens</i>	<i>Solidago erecta</i>
<i>L. Stuvei</i>	<i>S. puberula</i>
<i>L. angustifolia</i>	<i>Aster spectabilis</i>
<i>Strophostyles helvola</i>	<i>A. subulatus</i>
<i>Linum floridanum</i> , var.	<i>A. tenuifolius</i>
<i>intercursum</i>	<i>Baccharis halimifolia</i>
<i>Polygala Nuttallii</i>	<i>Bidens coronata</i>
<i>Corema Conradii</i>	<i>Lactuca floridana</i>

Thus it will be seen that, while there occur on the Elizabeth Islands something like 100 species belonging to a wideranging southwestern flora, Cape Cod not only has practically every one of these same plants, but boasts in addition at least an equal number of species of the same class which, so far as is known, are totally lacking from the islands.

It may be worth while to note, in passing, that, while an overwhelmingly large proportion of the more than 200 prevailing southern species which occur on Cape Cod occur likewise on Nantucket (and a considerably smaller proportion on Martha's Vineyard), that island has caught a number of these southern migrants which appear not to have succeeded in reaching the Cape. Several of these may be listed:

Eleocharis tricostata	Ascyron hypericoides
Scleria triglomerata	Lespedeza virginica
Carex Walteriana	Lechea Leggettii
Habenaria ciliaris	Ludvigia alterniflora
Quercus pagodaefolia	Pycnanthemum verticillatum
Polygonum robustius	Schwalbea americana
Amaranthus pumilus	Aster concolor
Ranunculus laxicaulis	

Sufficient evidence has probably been adduced to bear out the contention that the relations of the flora of the Elizabeth Islands to that of the southern coastal plain are anything but prominently marked, and that this southern, or southwestern, element is much more strongly represented in the closely adjacent regions, especially Cape Cod and Nantucket. An attempt to determine the causes which account for this break in distribution will shortly be made.

The Northern Element. Although lacking many of the northern types which distinguish the floras of parts of Nantucket and the "Lower" Cape, the Elizabeth Islands are not entirely without their representation of plants whose affinities are prevailingly boreal. In all, about 50 such species, constituting nearly 9% of the total native flora, may be considered as belonging to this class. It is significant to contrast this number with the 150 northern plants (over 20%) listed by Bicknell for Nantucket.

In general, these northern species which occur on the Elizabeth Islands are plants which range from Labrador and Newfoundland south to Massachusetts and New Jersey or, in a few cases, Delaware or Maryland. Many of them range south of New England along the mountains but reach the coastwise southern limit of their distribution in Massachusetts, Long Island or New Jersey. In the list which follows those species marked with an asterisk are to be looked upon as essentially maritime.

*Ruppia maritima, var. subcapitata	Carex hormathodes
*Triglochin maritima	C. silicea
*Agrostis stolonifera, var. compacta	C. canescens, var. disjuncta
Spartina Michauxiana	C. limosa
Glyceria obtusa	C. lanuginosa
G. canadensis	Eriocaulon septangulare
*Puccinellia pauperula, var. alaskana	Juncus pelocarpus
Eleocharis uniglumis	J. militaris
Scirpus campestris, var. paludosus	J. articulatus
Eriophorum tenellum	Sisyrinchium angustifolium
Rynchospora fusca	Liparis Loeselii
	Betula populifolia

*Rumex maritimus, var. fueginus	Hypericum boreale
Arenaria lateriflora	Epilobium palustre, var. monticola
Sagina procumbens	Myriophyllum tenellum
*Ranunculus Cymbalaria	*Ligusticum scoticum
Drosera rotundifolia	*Coelopleurum lucidum
Fragaria virginiana, var. terrae-novae	Menyanthes trifoliata, var. minor
*Potentilla pacifica	Chamaedaphne calyculata
*Lathyrus maritimus	Vaccinium macrocarpon
Rhus glabra, var. borealis	Limosella subulata
Ilex verticillata, var. fastigiata	*Plantago juncoides, var. decipiens
	Anaphalis margaritacea

The Elizabeth Islands, then, appear to have received their share of those far-ranging northern types which probably owe their existence in coastal New England, and southwestward, to the former presence of the broad continental shelf, already referred to, which permitted of their extension to the southwest and then, following its submergence, left them stranded at isolated localities along the coast. This would also explain why these islands possess fewer such plants than Martha's Vineyard (see p. 173) and still fewer than either Nantucket or the outer portion of Cape Cod. For, if these boreal species reached southeastern New England from off the elevated coastal bench to the eastward, then it seems logical to assume that a greater number of them would have found a refuge on Nantucket and the "Lower" Cape and that a smaller proportion would have succeeded in finding their way to the areas inland to the west, especially if, as may well have been the case, the retreat of the glacial ice from the latter region lagged appreciably behind its retreat from Nantucket, Martha's Vineyard and Cape Cod.

The Continental Element. It is only when we come to consider the continental element as it appears on the Elizabeth Islands that we find ourselves dealing with the type of vegetation which lends a dominating color to their flora. Probably more than 400 plants (about 70% of the total indigenous flora) from these islands are neither prevailingly southern nor northern in their distributional affinities but belong, rather, to a widespread continental flora which might be characterized, somewhat arbitrarily, as Canadian-Alleghanian in nature. This, it will be recognized immediately, is an attribute which the Elizabeths share in common with the upper or inner part of Cape Cod, and, indeed, there is every reason to suppose that the flora of these islands may, until comparatively recent geologic times, have been continuous with that of the line of hills which runs from

Falmouth to Bourne, and even north nearly to Plymouth. This entire ridge represents a terminal moraine which, beyond Cuttyhunk, dips below sea level reappearing, as some geologists believe, to form Block Island and, farther west, a portion of Long Island. The separation of the Elizabeth Islands from the mainland and their division into the seven present members of the chain are, as has already been indicated, relatively modern events. So it is entirely in keeping with the past history of this region that so many of the types which are abundant throughout the Falmouth area should likewise be common on the islands.

The relation of the flora of the Elizabeth Islands to that of the mainland comes out most clearly upon an examination of the forest types. The trees have already been listed (p. 151), but it seems entirely justifiable to repeat in this place that the native woods of the islands are made up not only of beech, *Fagus grandifolia* (surely not a coastal plain type), but also contain *Carya alba*, *Ostrya virginiana*, *Quercus alba*, *Q. velutina*, *Sassafras officinale*, *Hamamelis virginiana*, *Acer rubrum*, *Cornus florida* and *Nyssa sylvatica*. Now these trees, while they may and do occur on the coastal plain, are nevertheless more common and more clearly at home on the richer soils of the Piedmont and the areas inland, often reaching their finest development on wet wooded slopes and the alluvia of river valleys.

Under the trees listed above, on the wetter parts of the forest floor, occur such plants as *Carex lupulina*, *Arisaema triphyllum*, *Oakesia sessilifolia*, *Maianthemum canadense*, *Medeola virginiana* and *Trientalis borealis*. These again are types more commonly associated with an Alleghanian woodland flora. The beech drops, *Epifagus virginiana*, a rare plant in southeastern Massachusetts, occurs everywhere in the wooded parts of Naushon and Nashawena, and many other cases of this sort might be cited.

It would be superfluous to list here all of the species of Canadian-Alleghanian affinities which occur on the Elizabeth Islands. An enumeration of them would include most of the names of native plants in the Catalog that follows which have not been listed above in dealing either with the Southern or Northern Elements. A few of the most typical, however, not including the few trees mentioned above, may be given for the sake of comparison:

Polypodium virginianum
Asplenium platyneuron

Athyrium angustum
Osmunda cinnamomea

<i>Ophioglossum vulgatum</i>	<i>Amelanchier oblongifolia</i>
<i>Isoetes Engelmanni</i>	<i>Geum canadense</i>
<i>Sparganium americanum</i>	<i>Geranium maculatum</i>
<i>Sagittaria latifolia</i>	<i>Acalypha virginica</i>
<i>Andropogon furcatus</i>	<i>A. digyneia</i>
<i>Glyceria striata</i>	<i>Callitriche heterophylla</i>
<i>G. pallida</i>	<i>Rhus typhina</i>
<i>Elymus virginicus</i>	<i>R. Vernix</i>
<i>Cyperus diandrus</i>	<i>R. Toxicodendron</i>
<i>C. rivularis</i>	<i>Ilex verticillata</i>
<i>Scirpus cyperinus</i>	<i>Impatiens biflora</i>
<i>Eriophorum virginicum</i>	<i>Vitis labrusca</i>
<i>Carex rosea</i> , var. <i>radiata</i>	<i>V. aestivalis</i>
<i>C. cephalophora</i>	<i>Viola papilionacea</i>
<i>C. crinita</i>	<i>V. pallens</i>
<i>C. virescens</i>	<i>Ludvigia palustris</i>
<i>C. communis</i>	<i>Cicuta maculata</i>
<i>C. pennsylvanica</i> , var. <i>separans</i>	<i>Sium suave</i>
<i>C. digitalis</i>	<i>Heracleum lanatum</i>
<i>C. debilis</i> , var. <i>Rudgei</i>	<i>Monotropa uniflora</i>
<i>C. lupulina</i>	<i>M. Hypopithys</i>
<i>Arisaema triphyllum</i>	<i>Epigaea repens</i>
<i>Symplocarpus foetidus</i>	<i>Gaultheria procumbens</i>
<i>Acorus Calamus</i>	<i>Lysimachia quadrifolia</i>
<i>Juncus effusus</i> , var. <i>solutus</i>	<i>L. terrestris</i>
<i>Oakesia sessilifolia</i>	<i>Trientalis borealis</i>
<i>Lilium philadelphicum</i>	<i>Apocynum androsaemifolium</i>
<i>Maianthemum canadense</i>	<i>Verbena hastata</i>
<i>Medeola virginiana</i>	<i>Scutellaria galericulata</i>
<i>Habenaria bracteata</i>	<i>Pycnanthemum muticum</i>
<i>H. clavellata</i>	<i>P. flexuosum</i>
<i>H. orbiculata</i>	<i>Epifagus virginiana</i>
<i>Arethusa bulbosa</i>	<i>Cephalanthus occidentalis</i>
<i>Boehmeria cylindrica</i>	<i>Triosteum perfoliatum</i>
<i>Polygonum scandens</i>	<i>Sambucus canadensis</i>
<i>Phytolacca americana</i>	<i>Lobelia cardinalis</i>
<i>Ranunculus delphinifolius</i>	<i>Solidago juncea</i>
<i>Anemone virginiana</i>	<i>S. canadensis</i>
<i>Coptis groenlandica</i>	<i>Aster divaricatus</i>
<i>Spiraea tomentosa</i>	<i>Cirsium discolor</i>

The great bulk of these plants are species primarily of the interior; they attain their fullest development in the Piedmont and the Uplands and their occurrence on the coastal plain may be regarded, in most cases, as rather casual.

In summing up, it need merely be pointed out that the Elizabeth Islands, while serving, as does every other locality along the Atlantic coast, as a meeting ground for both northern and southern species of plants, exhibit both qualitatively and quantitatively a very strong

relationship with a widely dispersed flora of a continental nature, a fact which seems readily explicable upon the basis of the close connection existing between these islands and the inner, hilly part of Cape Cod, both as regards geologic history and general topography.

Finally, there remains to be considered, as briefly as may be, the subject of the last glacial advance over this region and its possible effects in influencing the present-day distribution of the flora.

Glacial History. Probably the greatest student of the geology of southeastern Massachusetts since the days of N. S. Shaler, was the late J. B. Woodworth of Harvard University. Professor Woodworth had prepared, shortly before his death, an exhaustive treatment of the glacial history of the Cape Cod region. This manuscript, unfortunately, still awaits publication and the details which it embodies are not yet available. Happily, however, Woodworth had related his broader conclusions to A. P. Brigham, geologist to Colgate University, and the main arguments are set forth by Brigham in his popular book entitled "Cape Cod and The Old Colony."

According to Woodworth, the advance of the last or Wisconsin ice over southeastern Massachusetts took place not as a solid sheet, but in the form of three tongues or lobes. One of these, the "Buzzards Bay Lobe," came down over the region now occupied by Buzzards Bay and deposited as a frontal moraine much of the material which now forms the line of high hills along the northwest shore of Martha's Vineyard, from Menemsha to West Chop. Then, following an interval which represented a retreat and a second advance of the ice, this lobe laid down, as a secondary moraine, the ridge which made the Elizabeth Islands and the "Upper Cape." The line of the islands, as may be seen from a map, almost exactly parallels the line of the morainal hills on the northwest shore of the Vineyard.

The second lobe, which lay to the east of the "Buzzards Bay Lobe," advanced southward over what is now the middle section of Cape Cod and laid down, as a terminal moraine, the sand, gravel and boulders which form the northeast shore of Martha's Vineyard and the higher, crescent-shaped portion of Nantucket. This Woodworth terms the "Cape Cod Lobe." This lobe then retreated, as did the Buzzards Bay Lobe and, as its secondary moraine, deposited the till which composes the "backbone" of Cape Cod from Sandwich to Brewster and Orleans. Thus, Martha's Vineyard was built by the combined action of two lobes and the central and southern parts of the island

represent an outwash or apron plain derived from two separate moraines. The southern and southeastern parts of Nantucket and almost the entire south shore of the Cape likewise represent outwash plains, both formed from the materials deposited by the Cape Cod Lobe.

Still further to the eastward, the third, or "South Channel Lobe" advanced over the area now submerged and known as Georges Banks. With the deposits of this lobe we are not so much concerned, as they now lie mostly beneath the sea, save for such materials as may have contributed to the building of the outer or lower part of Cape Cod. How far this lobe may have extended eastward over the then elevated continental shelf is apparently not definitely known.

It now becomes pertinent to inquire into the relative ages of these deposits and as to whether any evidence is forthcoming to indicate at what time and in what manner the various lobes retreated. Probably Woodworth's report, when it becomes available, will throw much light on this question. However, the writer has it on the authority of Dr. Wigglesworth of the Boston Society of Natural History, who is conversant with Woodworth's views, and who is himself a student of the geology of Martha's Vineyard, that in all probability the middle or Cape Cod lobe was the first one to retreat. If this was the case, it then means that Nantucket, the eastern part of Martha's Vineyard and the central part of Cape Cod were free of ice at a time when the regions to the east and to the west were still covered by the South Channel and Buzzards Bay lobes respectively. Remembering that the coastal shelf was probably considerably higher at that time than it is today, and that the Vineyard, Nantucket and the Cape may well have been continuous dry land, it at once becomes apparent that there was thus opened up an area which soon became available as a refuge for that migration of southern coastal plain species of plants which probably began as soon as the ice commenced to retreat.

It is necessary to point out here that there is a lack of complete agreement as to the exact period of subsidence of the continental shelf and as to whether this migration might have occurred *previous* to the advent of the Wisconsin ice or whether it could not possibly have taken place until after the glacier had receded.

Douglas Johnson, the eminent student of coastal phenomena, in discussing the date of submergence of the Banks cuesta (i. e., the New England-Acadian portion of the outer coastal shelf) states that

“we should expect the subsidence to be at least post-Miocene and more probably post-Pliocene.”¹ And further, “It seems probable that the date of submergence of the drowned topography must be post-Tertiary.”² Johnson, then, is inclined to view the elevation of the continental shelf as pre-glacial rather than post-glacial, a condition which would have necessitated the plant migration having antedated the advent of the Wisconsin ice. And, indeed, Fernald sees no reason why these plants should not have moved northeastward along the exposed shelf before the coming of the Wisconsin glaciation and “have persisted outside the subsequently glaciated area, finally taking possession of their present isolated habitats on the receding of the ice.”³

In connection with the present study, however, it matters little whether these species of the southern coastal plain reached the New England area before or after the last glaciation. In either case they must have moved inland from off the broad shelf to the eastward to take the places left vacant for them by the recession of the ice, and if we are justified in assuming that it was the Cape Cod Lobe of the glacier which receded first, then we are in a position to understand why so many of these species are to be found upon Nantucket and the “Middle” Cape, and, to a lesser degree, upon the eastern portion of Martha’s Vineyard and are so generally lacking from the Elizabeth Islands and inner Cape Cod. Even if the western half of the Vineyard, the Elizabeth Islands and the “Upper” Cape were free from ice at the time when this migration was operative, it seems likely that they offered a type of habitat which was less attractive to these coastal plain plants than the low-lying silicious areas of Nantucket and the “Middle” Cape which they must have reached first and where they today abound, seldom exhibiting a tendency to widen their ranges into the neighboring regions. And although, as Fernald suggests, these plants may have persisted upon the outer shelf while the ice still covered the area inland, it is nevertheless probable that the Nantucket-“Middle” Cape region would have been the first to witness their return.

Conclusion: In summing up, it may be said that, considered from the viewpoint of broad, geographic origins, the native flora of the

¹ Johnson, D. *The New England-Acadian Shoreline*. New York. 302 (1925).

² *Ibid.* 312, 313.

³ Fernald, M. L. *A Preliminary Statement of Results of Studies on the Northeastward Distribution of the Coastal Plain Flora*. *Amer. Jour. Sci.* 4th Ser. xl. 18 (1915).

Elizabeth Islands is seen to consist of three distinct elements. In the first place, there are those species (less than 20%) which exhibit a relationship with the flora of the southern coastal plain. Their presence upon these islands is to be explained upon the basis of a former land connection with New Jersey and southward which took the form of an elevation of the outer coastal bench, now submerged, and which, either prior to or following the Wisconsin glaciation, permitted of the migration of plants from the southwest to the New England area and even farther north and east. That so many more of these southern plants occur upon Cape Cod and Nantucket than upon the Elizabeth Islands is probably to be explained by the behavior of the glacial lobes which covered this area and which, by their differential recession, seem to have rendered the former areas accessible to occupation by plants at an earlier date. Secondly, there is a small percentage (less than 9%) of plants displaying a boreal affinity, the occurrence of which may be attributed to a counter extension southward along this same uplifted shelf. And the fact that the Elizabeth Islands have received a smaller number of these northern representatives than either Cape Cod or Nantucket is probably to be accounted for on the basis of their inland position and the character of the habitat which they offer, which is, in general, less favorable for these northern plants than the situations which they occupy on the "Lower" Cape. And, finally, there is the overwhelming majority (over 70%) of plants occurring on the Elizabeth Islands which show an essential relationship with the flora of the mainland and which give to the islands the dominating character of a Canadian-Alleghanian region. The prevalence of this continental element is doubtless due to the close geologic and physiographic similarity existing between these islands and the "Upper" Cape. Thus it will be seen that the evidence derived from a study of the geographic origin of the flora of the Elizabeth Islands fits rather well into what is already known concerning the history of the neighboring territory and that these islands take their place botanically as an extension of the adjacent mainland rather than as a link in that chain of outposts of a formerly continuous but now highly disrupted coastal plain flora extending from the South Atlantic States to Newfoundland.

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(To be continued)

GENTIANA PROCERA Holm, forma **laevicalyx**, n. f. calycium carinis, glabris.—Locally in Michigan and Indiana. MICHIGAN: shore of Lake Superior, *Whitney*; low wet grounds, Detroit, September 26, 1901, *Farwell*, no. 1447 c. INDIANA: frequent in one place in the sedge border of the north side of Bruce Lake, Fulton County, September 21, 1928, *Deam*, no. 46,341 (TYPE in Gray Herb.).

G. procera Holm, Ott. Nat. xv. 111, 179, t. xii. figs. 3–5 (1901), ordinarily has the keels of the calyx scabrous at least at base. Forma *laevicalyx* appears to be inseparable from it in any character except the quite glabrous calyx; but on account of this character it is likely to be mistaken for the much smaller *G. Victorinii* Fernald, RHODORA, xxv. 87, t. 139 (1923) of the estuary of the St. Lawrence. *G. Victorinii*, however, besides by its much smaller flowers, is distinguished from *G. procera*, forma *laevicalyx* by its shorter and more erect branches and peduncles, much less fringed corolla-lobes and stipitate (instead of essentially sessile) capsule.—M. L. FERNALD, Gray Herbarium.

THE IDENTITY OF ALOPECURUS AEQUALIS.—Following the lead of Schinz & Thellung,¹ progressive botanists have taken up the name *Alopecurus aequalis* Sobol. Fl. Petrop. 16 (1799) in place of the later *A. aristulatus* Michx. Fl. Bor.-Am. i. 43 (1803) or *A. fulvus* Sm. Engl. Bot. xxi. t. 1467 (1805). A discussion of the question was published by me in RHODORA, xxvii. 196 (1925). More recently, however, Jansen & Wachter, in a detailed study of the genus, *Floristische Aanteekeningen XXIV (Alopecurus)*, attempt to show² that the iden-

¹ Schinz & Thellung, Bull. Herb. Boiss. 2me sér. vii. 396 (1907); Viertelj. Naturf. Gesells. Zürich, lxvi. 291 (1921).

² Jansen & Wachter, Nederlandsch Kruidkundig Archief, Jaarg. 1929, Afl. i. 69 (1929).